

## **SECTION 11319 - SUBMERSIBLE LIFT STATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Scope: Furnish and install one submersible, non-clog lift station and all appurtenances necessary to complete same as shown or specified.
  - 1. The lift stations shall be complete with submersible sewage pumps, motors, discharge elbows, access hatch, guide system, piping, valves, electrical controls, flow meter, yard hydrant for cleaning, and appurtenances as shown on drawings. Hydro Flow incoming pipes dumping in below the minimum level. All components of the lift station shall be furnished by one manufacturer.
- B. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise specified. Where used in these specifications, the following acronyms shall represent:
  - 1. ANSI - American National Standards Institute
  - 2. ASTM - American Society for Testing & Materials
  - 3. HI - Hydraulic Institute
  - 4. NEMA - National Electric Manufacturer's Association

#### **1.2 QUALITY ASSURANCE**

- A. The pumping unit manufacturer shall test each pump for mechanical and electrical correctness.
- B. Perform field tests specified in this Section.

#### **1.3 SUBMITTALS**

- A. Submittals shall be submitted to the Utility and/or designee.
- B. Submit the following:
  - 1. Manufacturer's Certificate of compliance certifying compliance with the referenced specifications and standards.
  - 2. Shop drawings with performance data and physical characteristics.
  - 3. Manufacturer's installation instructions.
  - 4. Manufacturer's operation and maintenance material and manuals.

5. Certified copies of test reports.

#### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall be responsible for the delivery, storage, and handling of products.
- B. Load and unload all pumps, motors, and appurtenances by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Pad slings and hooks in such a manner to prevent damage to products.
- C. The pumps furnished shall be packaged in such a manner as to provide ample protection from damage during handling, shipment, and outdoor storage at the lift station site. All openings shall be capped with dustproof closures and all edges sealed or taped to provide a dust-tight closure.
- D. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Furnish complete a submersible lift stations consisting of submersible non-clog sewage pumps, motors, piping, valves, reinforced concrete wet well, electrical controls, guide system, and other appurtenances as specified in this Section and as shown on the drawings.
- B. Pumping units shall meet the requirements of HI standards.
- C. Pump materials shall meet the requirements of the latest editions of the following specifications:

<u>Material</u>	<u>ASTM or ANSI Designation</u>
Cast Iron	A-48 Class 30
Stainless Steel	ANSI Type 316L, 304, and 431
Bronze	B-144 Class 3B
Hot Rolled Steel	A 107-50-T Gr. 1015 .20 Cu. Min.
Cold Rolled Steel	A 108-50-T Gr. 1141 Turned, Ground & Polished
Pipe	ANSI A21.51

- D. Where applicable specifications are not designed herein, supply high class commercial grades of materials that meet the requirements specified and which are satisfactory to the Utility.

## 2.2 PUMP DESIGN

- A. Pumps shall be capable of handling raw, unscreened sewage and a minimum of 3 inch spherical solids.
- B. The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, which shall be permanently installed in the wet well. The pumps shall be guided by no less than two guide bars extending from the top of the station to the discharge connection.
- C. The pump shall be easily removable for inspection or service, requiring no bolts, nuts, or other fastenings to be disconnected. For this purpose, there shall be no need for personnel to enter the wet well.
- D. Each pump shall be fitted with a stainless steel lift bail and lifting chain of adequate strength and length to permit raising and lowering the pump for inspection and removal. The lifting system must permit the pump to be removed in one continuous motion, without intermediate hooking.
- E. The pump, with all its appurtenances and cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet.
- F. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.
- G. No portion of the pump shall bear directly on the floor.

## 2.3 PUMP CONSTRUCTION

- A. All major parts, such as stator casing, oil casing, sliding bracket, volute and impeller, shall be gray cast iron, Class 30, with smooth surfaces devoid of blow holes and other irregularities. All surfaces coming in contact with sewage shall be protected by an approved coating resistant to sewage. All exposed bolts and nuts shall be 304 stainless steel.
- B. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive-fitted to the volute inlet and

rotating stainless steel ANSI 304 ring which is drive-fitted to the impeller eye.

- C. The impeller shall be gray cast iron of a non-clogging design capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be slip fit to the shaft and key driven. Non-corroding fasteners shall be used.
  - 1. The volute shall be of single piece design and shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller.
- D. Pump shall be provided with a mechanical rotating shaft seal system consisting of two totally independent seal assemblies running in an oil reservoir having separate, constantly hydro-dynamically lubricated lapped seal faces. The (lower) seal unit between the pump and the oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring.
- E. The (upper) seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide ring and one positively driven rotating carbon ring. Each interface shall be held in contact by a spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. Shaft seals which are lubricated by oil and not the pumped liquid may utilize carbon and ceramic, Type 21, to be considered equal. The shaft sealing system shall be capable of operating when the pump is submerged to depths of/or pressures equivalent to 65 feet. No seal damage shall result from operating the pumping unit out of its liquid environment for extended periods of time. The pump shall be capable of operating for 24 hours in a dry condition without damage to the pump motor or mechanical seal.
- F. The pump shaft shall be stainless steel ANSI 420 stainless steel.
- G. The cable entry water seal design shall be such that precludes specific torque requirements to ensure a watertight and submersible seal. The cables shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit with cable and housing; strain relief and sealing of the cable is done separately within the body; the cable entry junction chamber and the motor shall be separated by a stator lead sealing gland or terminal board. Epoxy filled terminal housing shall be considered equal providing individual wire leads are spliced in the motor

terminal housing and the individual splice caps are filled with epoxy; such construction shall not require a terminal board to isolate the motor interior and the pump top.

- H. All mating surfaces of major parts shall be machined and fitted with nitrile O-rings where watertight sealing is required.
- I. Machining and fitting shall be such that sealing is accomplished by automatic compression in two planes and O-ring contact made on four surfaces. Square rings which provide the controlled compression of an O-ring and the ease of assembly of a flat gasket shall be considered equal.
- J. Tolerances of all parts shall be such that allows replacement of any part without additional machining required to ensure sealing as described above.
- K. Each unit shall be provided with an adequately designed cooling system. Thermal radiators integral to the stator housing, cast in one unit, are acceptable. Units which utilize an oil-filled motor and which operate considerably cooler than air-filled motors shall not require additional cooling to be considered equal. Thermal radiators integral to the stator housing, cast in one unit, are acceptable. Where water jackets alone or in conjunction with radiators are used, separate circulation shall be provided. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provision for external cooling and flushing shall be provided.
- L. Internal thermal sensors shall be required on each pump motor. Thermal sensors shall be used to monitor stator temperatures. There shall be one for each phase group in the motors. These shall be used in conjunction with and supplemental to external motor overcurrent protection, and they shall be located in the control panel. The internal thermal sensors shall show and/or sound an alarm and automatically shutdown the pump before motor damage occurs.
- M. Moisture sensing probes shall be installed in the mechanical seal cavity of each pump unit. These probes shall sense the intrusion of the pumped liquid into the seal cavity, send a signal to the panel mounted alarm device, and shut the pump down immediately. The alarm device shall be activated until the pump is removed from service/or repair.

## 2.4 GUIDE SYSTEM

- A. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection which, when bolted

to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps, or similar devices.

- B. Installation of a pump unit to the discharge connection shall be the result of a simple linear downward motion of the pump unit guided by two guide rails, a T-bar, or other suitable guide system.
- C. Guide rail pipes shall be constructed using 304 stainless steel or reinforced fiberglass material.
- D. No other motion of the pump unit, such as tilting or rotating, shall be required. No portion of the pump unit shall bear directly on the floor or wet well. There shall be no more than one 90 degree bend allowed between the volute discharge flange and station piping.

## 2.5 MOTOR

- A. The pump motor shall be housed in an air-filled, watertight casing and shall have moisture resistant Class F 155°C insulation. Oil-filled motors shall be considered equal providing they are the standard design of a U.S. manufacturer and do not utilize a heat shrunk, pressed in stator assembly. Thermal switches set to open at 120°C shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with supplemental to external motor overload protection and shall be connected to the control panel. The motor shall be NEMA design B and designed for continuous duty, capable of sustaining a minimum of 10 starts per hour. No motor winding damage shall result from operating the pumping unit out of its liquid environment for extended periods of time.
- B. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. Unless otherwise noted, provide adequate cable to complete the installation shown on the drawings.

## 2.6 ACCEPTABLE PUMP MANUFACTURERS

- A. Pumps by the following manufacturers will be considered acceptable:
  - 1. The Flygt Pumps
  - 2. Hydromatic Pumps
  - 3. Barnes

## 2.7 CONTROLS

- A. Controls for each pump station shall include two panels: Starter Panel and RTU (remote terminal unit) panel, and radio antenna installation. The RTU panel shall be integrated into, and be compatible with, the Utility utilities SCADA (supervisory control and data acquisition) system.
  - 1. Provide and install RTU panel as part of this contract.
  - 2. Provide and install RTU radio modem and antenna as part of this contract.
  - 3. Provide and install Starter Panel as part of this contract.
  - 4. Programming of RTU and integration to the SCADA system will be provided by the Owner.
- B. Remote Terminal Unit (RTU): Provide the Utility utilities SCADA system standard lift station NEMA 4X RTU panel. Design RTU as follows:
  - 1. RTU panel construction:
    - a. Enclosure shall be Hoffman A-30H2410SS6LP NEMA 4X stainless steel, complete with internal mounting panel.
    - b. RTU: Bristol Babcock Controlwave Micro 8 Slot CPU w/ 1 Ethernet and 2 serial communication ports.
    - c. 16 Pin Digital Output Card
    - d. 16 Pin Digital Output Card
    - e. 8 Pin Analog Input Card
    - f. 4 Pin Analog Output Card
    - g. IDEC 50 Watts, 24 Volt DC power supply
    - h. Powerware 3110 uninterruptable power source (UPS)
    - i. Series-wired, multi-stage hybrid, 3-stage, active-tracking, power-line protector. Innovative Technology, Inc., Model HS-120-10A.
    - j. Duplex utility receptacles
    - k. Esteem Ethernet Radio 195Es or MDS TransNET 900 spread-spectrum radio modem as directed by the Utility
    - l. Polyphaser bulkhead mount coaxial cable surge protector
    - m. Phoenix Contact fused power, two-level, and grounded three-level terminal blocks as required.
    - n. Phoenix Contact double-pole double-throw, terminal block style relays as required.
  - 2. Wire the RTU to accommodate the following input and output signals:

- a. Discrete Inputs:
    - (1) Pump 1 On/Off Status
    - (2) Pump 2 On/Off Status
    - (3) Pump 3 On/Off Status
    - (4) Wetwell High Water Level
    - (5) Station Power Failure
    - (6) Starter Panel Door Position
    - (7) Pump Failure
    - (8) Electrical Panel Door
    - (9) Instrumentation Panel Door
    - (10) Hatch Door
    - (11) Security Keypad
  - b. Discrete Outputs:
    - (1) Pump 1 Control
    - (2) Pump 1 Force Off
    - (3) Pump 2 Control
    - (4) Pump 2 Force Off
    - (5) Pump 3 Control
    - (6) Pump 3 Force Off
    - (7) Security Alarm Alert
    - (8) Security Disarmed
    - (9) Security Armed
  - c. Analog Inputs:
    - (1) Wetwell Level
3. Control interface between the RTU and the starter panel will be as follows:
- a. Under normal automatic condition, control the pump operation from the RTU.
  - b. RTU shall be able to turn (force) off any pumps in any mode.



C. Radio Antenna: Provide radio modem antenna, antenna tower, and antenna cable as required.

1. Antenna shall be directional type, pointed towards the Westfield North Elevated Water Tank.
2. Construct antenna tower from a 3 inch aluminum pipe, 24 feet high.
  - a. The bottom 4 feet shall be coated with bituminous coating and planted underground in concrete base. See drawings.
  - b. Antenna height shall be 20 feet above ground.
  - c. Cap top of pipe with matching cap.
  - d. Install antenna cable inside pipe.
  - e. Bond tower to electrical ground using #4 bare copper conductors.

D. Starter Panel: Provide NEMA 4X stainless steel starter panel, sized to accommodate starters and controls for specified pumps. Pump sizes shall be as indicated in the pump data sheet. Design starter panel as follows:

1. Panel Construction:
  - a. Provide padlocking hasp and staple, and matching stainless steel drip shield.
  - b. Install two 1/2 inch drains similar to Crouse-Hinds No. ECD17 at enclosure bottom, located on opposite sides.
  - c. Install two 1/2 inch breathers similar to Crouse-Hinds No. ECD16 at enclosure top, located on opposite sides.
  - d. Provide internal mounting panel and a swing-out panel.
  - e. Furnish properly sized industrial grade corrosion inhibitors inside the enclosure.
  - f. Provide thermostatically controlled, properly sized condensate heater. Mount heater on the lower portion of the enclosure internal mounting panel.
  - g. Furnish door actuated panel fluorescent light similar to Hoffman Catalog No. A-LFDA2.
  - h. Install all wiring within the enclosure in plastic wiring ducts. Do not mix low level signal wiring (24 Volts AD or DC) with high voltage wiring (110 Volts AC or greater) in the same duct.
  - i. Terminate all wiring at terminal blocks. Splices will not be permitted.
  - j. Seal all conduit entry originating from wet well to prevent moisture and gas vapors from entering the enclosure.
  - k. Provide twisted shielded pair cables for all low-level signal wiring (mA DC).

2. Terminate incoming power wiring at distribution lugs.
3. Provide service entrance-rated transient-voltage surge suppressor (TVSS) to protect all equipment mounted within the enclosure from switching surges and lightning induced surges. The TVSS shall be Innovative Technology, Inc., Model PTX080-NN400.
4. Distribute power through thermal magnetic circuit breakers and motor circuit protectors. Install units so that they are accessible from the front of the swing-out panel.
  - a. Provide a motor circuit protector (MCP) for each pump starter. Each MCP shall have adjustable instantaneous trip, and shall be sized for each load.
  - b. Provide circuit breaker for step-down transformer.
  - c. Furnish circuit breakers with minimum interrupting rating of 25,000 Amperes (AIC).
  - d. Provide phase band and voltage monitoring.
5. If incoming power is greater than 120/240 Volts AC, provide transformer to step down incoming power to 120 Volts AC. Transformer shall be high efficiency type, with 105° Celsius temperature class, extra regulation and low losses.
  - a. Minimum size of transformer shall be 1.0 KVA.
  - b. Protect transformer primary feeder with circuit breaker described above.
  - c. Size transformer to provide power to all 120 Volt AC loads listed below.
6. Distribute 120-Volt AC-power through single pole, 15-Ampere circuit breakers, each with 10,000 AIC.
  - a. Provide dedicated circuit breaker for each individual pump control circuit.
  - b. Provide a circuit breaker for alarm beacon, utility receptacle, panel light and thermostatically controlled enclosure heater.
  - c. Provide dedicated circuit breaker for pump failure monitoring circuit.
  - d. Provide dedicated circuit breaker for 24 Volts AC control transformer.
  - e. Provide dedicated circuit breaker for RTU Panel.

7. Furnish GFI (Ground Fault Interrupting) protected duplex utility receptacle. Mount unit so that it is accessible from the front of the swing-out panel.
  8. Provide full-voltage, non-reversing, NEMA-rated starter for each pump. (IEC-rated starters are not acceptable.) Size starters and thermal overloads according to motor nameplate data.
  9. Furnish industrial grade, heavy-duty, 30mm, oil-tight and watertight types, control devices.
    - a. Device contact blocks shall be rated 10-Ampere continuous.
    - b. Pilot lights shall be protected LED types rated for 100,000 hours of operation. Colors shall be as specified below.
    - c. H-O-A selector switches shall be provided with four (4) contact blocks: one (1) shall only close in “H” position, and three (3) shall only close in “A” position.
  10. Provide each pump with the following, swing-out panel mounted, controls:
    - a. An H-O-A selector switch.
    - b. An “ON” pilot light (red).
    - c. An “OFF” pilot light (green).
    - d. A non-resettable elapsed time meter.
    - e. A “HI-TEMP” pilot light (amber).
    - f. A “SEAL FAIL” pilot light (amber).
    - g. A “RESET” pushbutton.
  11. Provide the following auxiliary contacts from each starter:
    - a. Two normally open starter auxiliary contacts.
    - b. Two normally closed starter auxiliary contacts
    - c. One normally open auxiliary overload alarm contacts.
- E. Design each pump control circuit as follows:
1. RTU output (“force off”) shall be able to stop pumps at any mode.
  2. When H-O-A selector switch is in “H”, the pump motor shall run.
  3. When in “O”, the pump motor shall be off.
  4. When in “A”, in normal condition, the pump shall be controlled by RTU output (“pump control”). Pump will shutdown on high motor winding temperature condition.

5. When in “A”, in high wetwell condition, the pump shall operate when high level float makes, and stops when low level float breaks.
  6. Energize amber “HI-TEMP” light when thermal overload relay trips, or when motor winding temperature detector trips.
  7. Energize amber “SEAL FAIL” light when seal failure contacts trip.
  8. Provide single contact for RTU monitoring of all pump failure conditions.
- F. Provide motor high winding temperature and motor seal failure detector for each pump. Detector circuit shall shut down motor when detector trips. Motor shall remain shut down until associated “RESET” push button is pressed.
- G. Provide dry contacts as necessary for RTU monitoring purposes.
1. Terminate RTU input and output wiring at terminal blocks, grouped and dedicated for RTU interface wiring.
  2. Provide extra relays as necessary to achieve intended operation and monitoring.
- H. Furnish high and low float switches, which shall be constructed as follows:
1. The float switches shall be watertight, mechanical snap-action type, encased in a chemical-resistant polypropylene casing. Float shall be Model ENM-10 Liquid Level Sensor as manufactured by Flygt, or equal.
  2. Suspend each float switch on its own cable, which shall be long enough to reach wetwell floor. Each switch shall be weighted with enamel coated cast iron weight to permit float to pivot for proper operation.
  3. Install floats using stainless steel hardware.
  4. Float switch elevations shall be adjustable over the entire wet well depth.
- I. Furnish a submersible hydrostatic pressure type level sensor.
1. The hydrostatic pressure type level sensor shall be submersible type, suspended on its cable. The sensing diaphragm shall be

provided with an end-cap and 304 stainless steel eyebolt.

- a. Select sensor range based on wetwell depth.
    - b. Sensor output shall be 4 to 20 mA DC proportional to water level, 2-wire type, with loop power supply of 9 to 30 Volts DC.
    - c. All exposed parts shall be constructed of 316 Stainless Steel
  2. Fabricate a Teflon coated marine anchor. Weight of anchor shall not exceed 5 pounds.
  3. Attach concrete cylinder to the level sensor eyebolt using stainless steel aircraft cable and mechanical crimp. Adjust cable length so that sensing diaphragm is at 12 inches above the cylinder bottom surface.
  4. Lower sensor assembly until concrete cylinder rests on wetwell floor. Pull sensor cable taut until sensing diaphragm is at 12 inches above wetwell floor. Do not hang concrete cylinder from sensor cable.
  5. Provide at least 10 foot excess cable. Coil excess cable on stainless steel cable rack at top of wetwell.
- J. Provide an alarm beacon light, which shall be energized on high water alarm condition. Alarm beacon light shall be as follows:
1. Watertight, suitable for outdoor installation and provided with a red lens.
  2. Light source shall be high intensity strobe type, with light intensity of 1,000,000 (1-million) peak candlepower.
  3. Mount unit on top of starter panel enclosure using watertight conduit hub, similar to Myers ST-1, T&B 401, or OZ-Gedney CHM-50T.
- K. Acceptable Manufacturers:
1. Motor starters and control components: Allen Bradley.
  2. Circuit breakers and motor circuit protectors: Square D.
  3. Level sensor:

- a. Viatran, model 517, or
  - b. Endress+Hauser.
4. Beacon light: Federal Signal "Fireball 2".

## 2.8 PIPING MATERIALS

- A. Ductile iron pipe shall meet the requirements of ANSI Specification A21.51 (AWWA C151). Design and manufacture pipe for a working pressure of 150 psi plus 100 psi surge and a safety factor of 2 and a depth of cover indicated on the drawings and specified in this Section. Minimum thickness class shall be 350.
- B. Pipe joints shall be push-on type. Joints shall meet the requirements of ANSI/AWWA A21.11/C111. Restrained joints shall be Lok-Ring, Lok-Fast, Lok-Tyte, or approved equal.
- C. Fittings shall be cast iron or ductile iron. Fittings shall meet the requirements of ANSI/AWWA C110. Design and manufacture fittings for a pressure rating of 250 psi. Fitting joints shall be mechanical joints or restrained push-on joints. Joints shall meet the requirements of ANSI/AWWA A21.11/C111. Thrust blocking or restrained joints as required or if necessary.
- D. Gate valves 4 inch and larger shall be full ductile iron body, epoxy fusion bounded inside and out, non-rising stem gate valves. Valves shall meet the requirements of ANSI/AWWA C500 or C509 and shall have mechanical joint ends. Exposed bolts and nuts shall be stainless steel. Joint accessories shall meet the requirements of ANSI/AWWA C11/A21.11. Valve opening direction shall be counter-clockwise.
  1. Gate valves 4 inch and larger installed in structures shall be full ductile iron body, outside screw, and yoke gate valves. Valves shall meet the requirements of ANSI/AWWA C500 or C509, except those parts of ANSI/AWWA C500 or C509 only applicable to non-rising stem gate valves and wrench nuts. Outside screw and yoke gate valves shall have flange joint ends and malleable iron handwheels. Flange joints and accessories shall meet the requirements of ANSI/AWWA C110. Nuts and bolts shall be stainless steel. Gaskets shall be full face and shall be red rubber or approved equal.
  2. Gate valves shall be as manufactured by Waterous, U.S. Valve, or approved equal.

- E. Plug valves shall be manually operated, with worm-gear operator handwheel. Stainless steel extension operating stems shall be provided for those valves utilizing floorstand operators.
1. Plug valves shall be as manufactured by DeZurik, or approved equal.
  2. All plug valves shall be eccentric plug valves unless otherwise specified.
  3. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA C111-64, grooved ends per AWWA C606-87. Screwed ends shall be to the NPT standard.
  4. Valve bodies shall be of ASTM A126 Class B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.
  5. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.
  6. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF-8M in 1/2" sizes. In valves larger than 36", the upper and lower plug journals shall be fitted with ASTM A240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.
  7. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

8. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.
9. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc., as indicated on the plans. All valves 6" and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.
10. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.
11. Actuators shall be equipped with an operating nut to allow manual valve operation in case of supply failure.
12. All valves and actuators shall be as manufactured by DEZURIK, Pratt, Val-matic or approved equal.
13. All buried service plug valves shall have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-C-494A Asphalt Varnish with 2 inch square nut operator in a vertical position for use in a valve box. Provide nut operator stem extension for all plug valves buried deeper than 5 feet, sufficient to raise operator nut to within 3 feet of finished grade.



- F. Single disc, swing check valves, 4 inch and larger, shall be used in sewage pump stations and shall be iron body, bronze-mounted, swing check, bolted cover, flanged ends, 125 psig working pressure, AWWA C508, suitable for use in a horizontal position. Flanges shall conform in dimensions and drilling to ANSI B16.1.

- 1. Swing check valves shall have outside weight and lever.

## 2.2 CONCRETE WET WELL AND VALVE VAULT

- A. The Contractor shall furnish and install a water-tight, monolithic concrete or precast manhole type wet well as indicated on the drawings which is to be lined with Spectrashield and the first manhole that the forcemain from the lift station empties into is also to be lined. An on-site backup generator with an auto transfer switch shall be furnished and installed by the Contractor. Pump and related equipment shall be installed and/or mounted as shown.
- B. A water-tight, concrete valve vault shall be furnished and installed to house the valves and appurtenances. Drain and backflow preventer shall be installed from the valve vault to the wet well.
- C. Precast manhole sections shall conform to requirements of ASTM C478 and be water tight.
- D. Contractor may offer wet well sections conforming to ASTM C76, Class IV, Wall B pipe sections if shown on the drawings.

## 2.2 ALUMINUM HATCH

- A. Frame shall be 1/4 inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to exterior. Cover leaf shall be 1/4 inch aluminum reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to underside and pivot on all stainless bolts and hardware shall be used. The cover shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release and close the cover with one hand. Covers shall be built to withstand a live load of 150 pounds per square foot, and equipped with a snap lock and removable handle. When closed, covers shall not protrude above the operating surface in which they are installed. Factory finish shall be aluminum lacquer. Surface contacting concrete shall have bituminous coating.
- B. Covers shall be diamond pattern plate.

- C. Hatches shall have an interior safety hatch.
  - 1. The safety hatch shall be designed to cover the complete opening maintaining a fall through protection per OSHA Standard 1910.23 and controlled confined space entry per OSHA Standard 1910.146.
  - 2. Doors cannot be closed unless the fall through protection has been put back in place (protecting the next worker).
  - 3. Allows visual inspections, limited maintenance and float adjustment while safety grate is left in place.
  - 4. Open grates create a physical barrier around the pit, protecting passing pedestrians.
  - 5. Safety orange color promotes a visual awareness of the hazard.
  - 6. Quality materials provide superior corrosion resistance.
  - 7. Pump platform. Pumps can be pulled from the pit then suspended, the grating closed, and the pump set back on the grating. This allows for pump wash downs directly back into the pit to prevent EPA clean-up due to site contamination.
- D. Aluminum covers shall be Bilco Type K or KD, Flygt, or approved equal.
- E. When flush mounted covers are furnished, provide two wrenches for opening covers.
- F. Valve vault cover shall be water tight with drain system.
- G. The Contractor shall provide padlocks for new wet well and valve vault covers. The locks shall be keyed alike with a lock provided by the Owner.

## PART 3 - EXECUTION

### 3.1 INSPECTION

Inspect all pumps, motors, and appurtenances prior to installation in the work. Promptly remove damaged or unsuitable products from the job site. Replace damaged or unsuitable products with new, undamaged and suitable products.

### 3.2 INSTALLATION

- A. Install the submersible pumps in accordance with the drawings and manufacturer's written instructions.
- B. The discharge elbow of each pump shall be securely anchored to the wet well base and properly aligned with the guide system and upper guide bracket.
- C. The discharge piping shall be properly anchored and supported inside the manhole.
- D. All electrical work shall be done by a qualified electrician and shall conform to the National Electric Code.

### 3.3 TESTING

- A. Pump Testing: Each pump shall be fully tested in accordance with manufacturer's written instructions. Certified copies of the test results shall be furnished with each pumping unit. Record the test voltage and amperage measurements.
- B. Wet Well Leakage Testing: Contractor shall perform leakage tests on wet well under supervision of the Utility and/or designee. This shall be an exfiltration test performed in the following manner:
  - 1. After wet well has been assembled in place, all lift holes shall be plugged with an approved non-shrink, non-metallic waterproof mortar. The test shall be made prior to placing any backfill material. If the water table has been allowed to rise above the bottom of the wet well, it shall be lowered for the duration of the test. All pipes and other opening into the wet well shall be suitably plugged by means of pneumatic plugs that have a sealing length greater than the diameter of the pipe and are capable of resisting test pressure without external bracing or blocking.
  - 2. The wet well shall then be filled to the top with water. The water shall be allowed to remain for 4 – 6 hours to permit absorption by wet well walls, and then top off water to the test level prior to starting the test. If the excavation has not been backfilled and observations indicate no visible leakage after one hour, the wet well shall be considered to be satisfactorily water-tight. If the test, as described above, is unsatisfactory, or if the wet well excavation has been backfilled, the test shall be continued. A period of time up to 24 hours may be permitted to allow for adsorption. At the end of

this period, the wet well shall be refilled to the top, and the measuring period of at least 8 hours begun. At the end of this test period, the wet well shall again be filled to the top, while measuring the volume of water added. This amount shall be extrapolated to a 24 hour rate and the leakage determined on the basis of depth. **The leakage for a wet well shall not exceed one gallon per vertical foot for a 24 hour period.** If this requirement is not met, but the leakage does not exceed two gallons per vertical foot per 24 hour period, repairs by approved method may be made as directed by the Utility to bring the leakage within the allowable rate. Leakage due to a defective section or joint, or exceeding the two gallon per vertical foot per 24 hours maximum, shall be cause for rejection of the wet well. It shall be the Contractor's responsibility to uncover the wet well as necessary and to disassemble, reconstruct, or replace it as directed by the Utility. The wet well shall be retested after any repairs or replacement.

3. No adjustment to the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc.; it will be assumed that all loss of water during the test is a result of leaks through the joints or through the walls. Further more, the Contractor shall take any steps necessary to assure the Inspection that the water table is below the bottom of the wet well throughout the test.

### 3.4 WARRANTY

- A. The pump manufacturer shall warrant the pumps being supplied to the Owner against defects in workmanship and materials for a period of five years under normal use, operation, and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear or a progressive schedule of cost for a period of five years; parts included are the mechanical seal, impeller, pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all units. The warranty shall not start until the equipment has been placed in operation for beneficial use as determined by the Owner.
- B. The manufacturer shall provide the services of a factory trained representative for a period of one day at each lift station to perform initial start-up of the pumping station, to instruct operating personnel in the operation and maintenance of the equipment, and to demonstrate satisfactorily the performance of each piece of equipment.

- C. All equipment supplied and installed under this item of the specifications shall meet the requirements of the Occupational Safety & Health Act of 1970.

## SUBMERSIBLE LIFT STATION DATA SHEET

### 1. GENERAL INFORMATION

- A. Lift Station Name: \_\_\_\_\_
- B. Application: Wastewater
- C. Location: \_\_\_\_\_

### 2. OPERATING CONDITIONS

- A. Pumping Temperature Range: 55°-70°F
- B. Vapor Pressure: 1 psig
- C. Product Handled: Domestic Wastewater
- D. Suction Head: \_\_\_\_\_

### 3. PUMP CHARACTERISTICS

<u>Flow Rate (gpm)</u>	<u>Total Dynamic Head (Feet)</u>	<u>Efficiency (%)</u>
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(List three or four points on pump curve)

### 4. PUMP DATA

- A. No. of Pumps: 2
- B. Type: Submersible Non-Clog
- C. RPM: \_\_\_\_\_
- D. Discharge Size: \_\_\_\_\_
- E. Motor HP: \_\_\_\_\_
- F. Motor Electrical Data: \_\_\_\_\_
- G. Manufacture & Model: \_\_\_\_\_

5. AVERAGE DESIGN FLOW: \_\_\_\_ gpm
6. WET WELL: 6'-0" Diameter
7. PUMP OPERATING RANGE: \_\_\_\_\_
8. AVERAGE WET WELL DETENTION TIME: \_\_\_\_\_

END OF SECTION 11319